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ABSTRACT

Two studies of concept development and categorization among 1-, 2-, and 3-year-old children suggest that concept formation is a socially guided process involving convergence on an adult model. Convergence in labeling is an early strategy for shaping children's category boundaries, while later, more elaborate linguistic means are used to differentiate and integrate members of categories. These devices include constructions like anchors and hedges, and serve a social function in that they are used to teach conventional category organization. The results of a sentence acceptance task show that children are able to use this information and that convergence on the adult network is sensitive to this measure. It is proposed that by constraining the use of these devices during the teaching period, it may be possible to test for a clear relationship between individual differences in parental use of these devices and variations in children's cognitive development in future research. (MSE)

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Sentence Frame Effects on Children's Category Judgments

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Research on categorization, and the influence of object typicality on categorization processes, can be informed by Vygotsky's ideas regarding socialized aspects of thinking. The present research questions the"pre-linguistic concept" view of concept development that has dominated a good deal of the research in this area (Schlesinger, 1982). From this perspective, children's early concepts and categories are constructed through a process of spontaneous invention. On the other hand, the influence of individual environmental experience and interactive context recently has begun to make it's way into our theories of concept development. However, the importance and nature of the ways in which concept development and category evolution are socially guided have continued to be neglected.

The problem is that our thinking about categorization has been dominated by an unfortunate legacy of Piagetian theory: the "Child as Mini-Scientist" view of cognitive development. Children are thought to construct basic concepts, categories, and complex ideas in relative isolation. The application of this scientist metaphor to the realm of concept development is unsatisfying, because it fails to answer a very important question. How do children's idiosyncratic experiences somehow ultimately result in a representational network that is shared by children and adults? What variables and processes account for the fact that each child's categories evolve to match a cultural standard? The answer is both simple and complex. The simple part is to claim that someone teaches us these things. The difficult part is to understand what collection of activities, abilitites, strategies, and predispositions underlies teaching.

In order to reconceptualize concept development and category evolution as processes involving learning, we need to abandon the child-as-scientist model and adopt a new metaphor. An alternative is the idea of "the child as apprentice" (Kaye, 1982). Children are apprenticed into the culture, and apprenticeship is a socially distributed process involving an expert and a novice. The outcome of an apprenticeship depends on the skills and intrinsic capabilities of the teacher, as well as those of the learner.

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We can think about some aspects of development in terms of convergence on an adult standard. In the case of semantic development, children are converging on a conventional representational network -- one that is functionally equivalent to that of adults. Practically speaking, they end up using words and ideas very much as others do. In short, they are apprenticed into the ways of speaking and thinking of their culture.

Consider the conventional organization of a category like BIRD. The category contains both central and peripheral members. Typical members of the category are commonly labeled "bird", unless the context calls for a more specific label. Atypical members of the category are commonly labeled with specific names, like "penguin" or "turkey", unless the context requires identification of the exemplar's taxonomic category membership (see Adams & Bullock, 1986). Generally speaking, this is the conventional organization of the category for adults in our society.This is an important point, because an apprenticeship model of development works best if you are able to specify the target of that developmental process (Adams, 1985). Presumably, parents do have some kind of target pattern in mind as they go about shaping and correcting children's patterns of labeling.

A child may have an unconventional BIRD category. His category includes some of the things adults call "Bird", but also includes bats. Somehow, the parent has to help the child separate the birds from the bats. "Duck" for this child may be an independent category -- it needs to be integrated into BIRD. "Penguin" may need to be disembedded from a SEAL category and then integrated into BIRD. "Turkey" and "chicken" may need to be cross-listed as both meats and birds. BIRD itself eventually will need to be differentiated into it's specific subtypes, like "crow", "robin", and so on (see Adams & Bullock, 1986). At the end of this process of category evolution the child's category will be organized in a more conventional manner. This process is socially guided; it is a social convergence process. Parents do things that lead to convergence of the child's idiosyncratic category on the conventional adult category.

What kinds of strategies do parents use to promote these changes? The first thing they do is Label and Re-label objects. Certainly, there are numerous studies that have looked at patterns of parental word use and their relationship to children's patterns of word use. For research that treats labeling from a socially guided perspective, I refer you to Mervis's pioneering work in the area (Mervis, 1984) and to work by Adams and Bullock (1986) which examines shifts in labeling patterns in one-, two-, and three-year-old children from a

social convergence perspective. Both of these lines of research focus on developmental changes in labeling practices per se.

More complex strategies -- strategies that are introduced after basic labeling patterns have been established -- are used to create two different kinds of changes in children's categories. They help differentiate the category into its subordinate subtypes and integrate peripheral members into the core category. These devices are used to shape category boundaries, and their use varies in relation to the typicality of the object being discussed. These "linguistic tools" are diverse, but in this research fall into four major groups. First are **Anchors** ("Dalmatian-dog"), where the introduction of a new label is linked to the old, previously established label (see also Clark et al., 1985). Second are **Modifiers** or modifying phrases ("spotted dog" for Dalmatian or "striped horse" for zebra), which modify the basic label and may form a bridge until the acquisition of a more phonologically complex subordinate level name is within the child's grasp. Third are **Statements of Class Inclusion** ("A penguin belongs to the bird family"), where the taxonomic category membership of the exemplar is specifically identified. Fourth are **Hedges** ("A penguin is a funny kind of bird" or "A zebra is sort of like a horse"), which acknowledge the non-transparent nature of the relationship between atypical exemplars and their conventional categories (see Lakoff, 1972, for work on adults' use of hedges).

Figures 1 and 2 show the distribution of maternal use of these linguistic devices in relation to exemplar typicality. Generic exemplars are non-descript -- the everyday dog or cat that may not have a proper subordinate level name. Typical exemplars are exemplars which have a specific subordinate level name -- like "bluejay" or "robin"-- which may or may not be selected on a particular occasion. Atypical exemplars are those which are peripheral to the category. They are generally labeled with their subordinate level names unless circumstances require some identification of taxonomic family membership.

These data are from an investigation which examined labeling patterns in middle-class mother-child dyads reading picture books. The children were 1, 2, and 3 years old and the objects they labeled were members of different animal categories (BIRD, DOG, CAT, DEER, BEAR, HORSE). Although these data have been collapsed across all three age groups, maternal use of these forms increases in frequency with the age of the child. Here the point is simply to illustrate that the use of the four sentence frames does indeed vary a function of exemplar typicality. They were very rarely used in conjunction with generic exemplars, where simple labels suffice. For typical exemplars, the use of

FIGURE 1

EFFECTS OF EXEMPLAR TYPE ON

MOTHERS' PROPORTIONAL USAGE OF LINGUISTIC FORM

(Study 1)

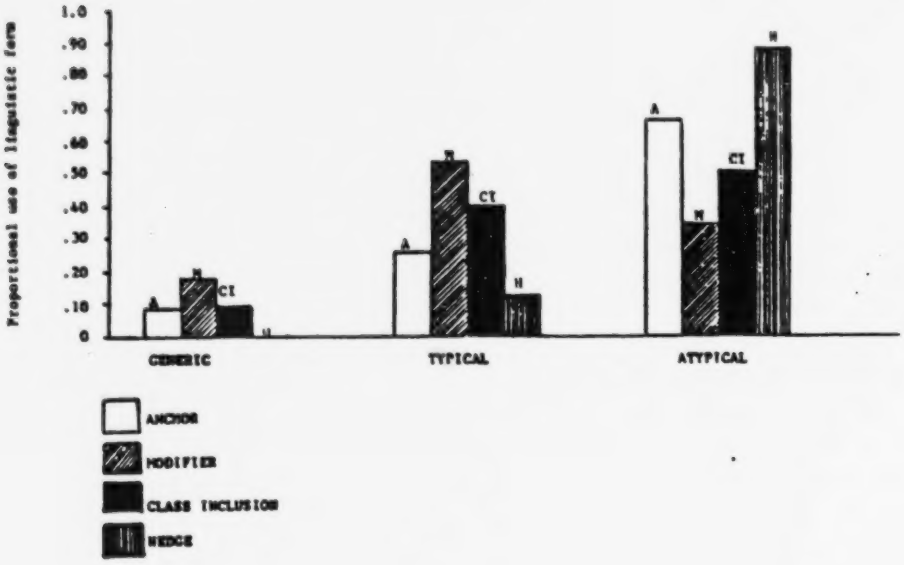
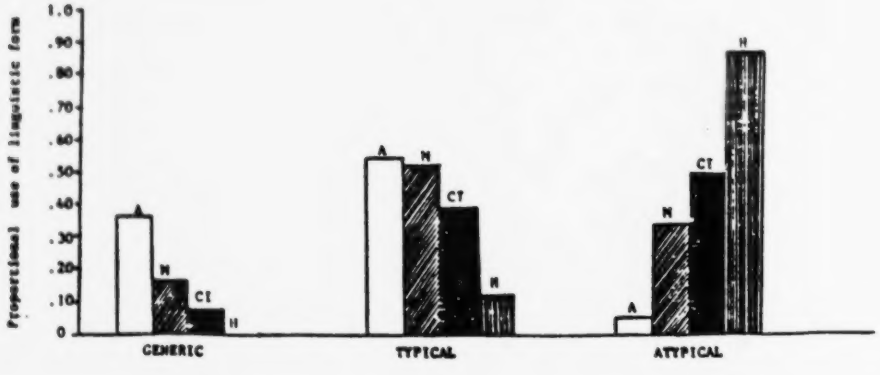


FIGURE 2

EFFECTS OF EXEMPLAR TYPE ON MOTHERS'

PROPORTIONAL USAGE OF LINGUISTIC FORM, ANCHORED BEARS REMOVED

(Study 1)



modifiers and statements of class inclusion was relatively high. The most common class inclusion statement for examplars of this sort was a "kind of" construction ("A robin is a kind of bird"). For Atypical exemplars, the relative use of these forms also was quite high. The change in the use of Hedges was quite significant -- they were used almost exclusively in relation to peripheral members of the categories.

The use of anchors is somewhat more complex. The high use of anchors for atypical exemplars in Figure 1 is in some ways an artifact. It was created almost entirely by the use of routinized phrases used in relation to members of the category BEAR. These are phrases, like "panda bear", "polar bear", and "koala bear"; there was neither reliable nor deliberate use of phrases like "penguin bird". This anchoring of atypical exemplars occurred only in relation to this category, and was incorrect in 2/3 of the cases and inevitable in the third (pandas and koalas aren't bears and the word "polar" only refers to bears when it's anchored). Thus,whether they should be considered deliberate teaching strategies is called into question. When the anchored bears are removed from the analysis the pattern of results shifts to that shown in Figure 2. Here, the proportional use of anchors occurred in relation to typical exemplars. Their occasional use in relation to generic exemplars occurred when mothers invented anchored names for these animals, imposing labels like "bay horse".

These results clearly establish that mothers spontaneously use these devices when speaking to children in a naturalistic educational setting. However, they cannot determine whether or not there is a relationship between maternal use of these forms and the development of children's categories. It's possible that children are not able to make use of the subtle distinctions in degree of category membership marked by these different sentence frames. The next study was designed to look at the effects of these forms on children's category judgments.

The second study was a mini-longitudinal study of mothers and their children, who were 3 years, 8 months old and came from middle class families in Denver, Colorado. Thirty-two dyads were randomly assigned to two picture book reading conditions, although for the purposes of this discussion, the data from these two conditions have been combined. The books themselves contained 36 colored drawings of animals from the same six categories used in Study 1. As in the previous study, these exemplars represented a range of typicality: Generic (highly typical), Typical, and Atypical. All children were pre- and post-tested on two measures of cognitive organization: (1) a card sorting task and (2) a sentence acceptance task. The pre- and post-test sessions

were separated by two weeks of at-home book reading. The results of the sentence acceptance task are of primary interest here (see also Adams, 1985).

The sentence acceptance task was a modified version of the standard sentence verification paradigm often used to assess levels of syntactic development. The child and an experimenter play a game with puppets in which the child is asked to judge the whether or not a particular utterance is acceptable and correct it if it is not. Here the task was used to assess category structure using those same sentence frames identified in the prior study: Hedges, Anchors, Modifiers, and Statements of Class Inclusion.

A subset of the animals appearing in the books was selected for the sentence acceptance task. These animals were both the most typical (and nameable) animals and the most atypical animals from each category, and were selected according to typicalty ratings obtained from a group of 10 adult raters. Thus, the typical animals appearing in the set were a robin, a Siamese, a collie, a palomino, an elk, and a grizzly. The atypical animals included were a penguin, a leopard, a Pekingese, a zebra, a moose, and a panda. There were 42 sentences in all. Six of these were warm-up sentences, and half of those remaining were distractor sentences, leaving a target set of 18 sentences. Linguistic frame was crossed with exemplar typicality for all portions of the set. For example, an Identity/Typical Sentence would be, "A robin is a bird"; an Identity/Atypical sentence would be, "A penguin is a bird". An Anchored/Typical sentence = "A Siamese-cat is a cat"; and Anchored/Atypical = "A leopard-cat is a cat". (Note that we have introduced anchors in relation to atypical exemplars, even though they did not spontaneously occur in this context in Study 1 --except in relation to bears). A Class Inclusion/Typical sentence = "A collie belongs to the dog family"; Class Inclusion/Atypical = "A Pekingese is a kind of dog". For Hedges, we excluded the Hedge/Typical condition, in part in an attempt to restrict the size of the set, which was becoming unmanageable for the children, and in part because sentences like "A robin is a funny sort of bird" are fairly odd themselves. Each sentence judgment was introduced with a picture of the target exemplar and the statement, "This is an X", followed by the specific test sentence (e.g., "This is a penguin. A penguin is a bird.")

The results showed that judgments of category membership for typical members of each category were virtually perfect for all sentence frames during both assessments. This means that the relative ease of making judgments or drawing inferences about category membership was affected by object typicality. When exemplars were typical, judgments were relatively easy and

insensitive to particular linguistic frame. This result is not surprising, given that the relationship of typical exemplars to their category is more conceptually transparent. Typical category members are the empirical base from which the child constructs the basic level category.

All effects for the sentence acceptance task were due to changes in children's willingness to include atypical exemplars in the category --that is, to judge sentences with atypicals as correct. In other words, convergence on the conventional category took the form of integrating peripheral members into the taxonomic category. More specifically, analyses of variance yielded the following pre- to post-test changes in children's membership judgments, by sentence frame. Changes in judgments of simple Identity sentences were only marginally significant ($p < .06$). Thus, children were only slightly more likely to include peripheral members in the core category when the relationship was posed as one of simple identity. There was no effect of training (i.e., no convergence) in Modifier sentences. Convergence in judgments involving Anchors jumped dramatically ($p < .001$) over the two week period. Children were much more willing to accept sentences like "A leopard-cat is a cat" during the second session. Thus, anchored phrases may be an effective strategy for teaching the category membership of peripheral members, even though it occurred very rarely in Study 1 (with the exception of the category BEAR). Statements of Class Inclusion also were far more likely to be accepted during the second session ($p < .01$). Hedges showed a highly significant jump in acceptance rate between the two sessions ($p < .001$), meaning that children who originally rejected sentences like "A penguin is a funny sort of bird" were far more willing to accept them after two weeks of picture book reading.

In sum, the results show large effects of Anchors, Class Inclusion Statements, and Hedges in judgments of category membership. There were marginal or no effects for Identity and Modifier sentences. This pattern of results is significant for two reasons. First, it shows that children are sensitive to the semantic information carried by these linguistic forms. They are able to use them to make category boundaries more flexible, as do adults. Thus, when helped by linguistic form, even three year old children may not be the dichotomous thinkers we so often accuse them of being. Second, the results show that for these children much of the change in category structure in this task involved integration of atypical members of the category into the conventional category, when the technical or tangential nature of that relationship was implicity acknoweledged by sentence frame. While

differentiation in naming practices for typical exemplars may also have been occurring (Adams & Bullock, 1986), this differentiation of the category into its subtypes does not necessarily reflect changes in understanding taxonomic organization per se. However, the transformation of a basic level category into a category that includes peripheral members may well set the stage for building a later understanding of class inclusion relationships.

In conclusion, I have argued that concept formation is a socially guided process involving convergence on an adult model.Convergence in labeling is an early strategy for shaping children's category boundaries. Later more elaborate linguistic means are used to differentiate and integrate members of categories. These devices include constructions like anchors and hedges, and serve a social function in that they are used to teach conventional category organization. The results of the sentence acceptance task show that children are able to use this information and that convergence on the adult network is sensitive to this measure. By constraining the use of these devices during the teaching period, it may be possible in future research to test for a clear relationship between individual differences in parental use of these devices and variations in children's cognitive development.

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